وزارة التعليم العالي والبحث العلمي

الجامعة المستنصرية

لافقريات ملون

مختبر

4.000

كلية العلوم ـ علوم الحياة
المرحلة الثانية

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مع تحيات ...

مكتب البيت الهندسي للطباعة والاستنساخ

مجاور الباب الرئيسي للجامعة المستنصرية

طباعة ـ استنساخ ـ سحب ليزري ملون ـ صور سريعة للمعاملات ـ كبس هويات ـ سبايرول ـ قرطاسية ـ انترنت

2024 - 2025

LAB. 1 **The invertebrates** include those animals which are without backbone as opposed to vertebrates in which a series of vertebrates constitute backbone. The invertebrate constitutes about 97% of the known animals which number over a million.

Taxon and Category:

relationship of the organisms. It enables us to find out the ancestors or derivatives of any taxon. The taxa are the groups of animals generally groups of species. Any such group of such population is called taxon.

Taxonomic Categories:

Kingdom : a taxonomic category of the highest rank, grouping together all forms of life having certain fundamental characteristics in common.

Phylum: is second highest unit of classification after Kingdom. It includes one or more related classes of animals. In plants, instead of phylum, the term 'division' is used.

Class : is a taxonomic group consisting of one or more related orders.

Order : is a taxonomic group containing one or more families.

Family : is a taxonomic group containing one or more related genus.

Genus : is a taxonomic group including closely related species.

Species : A group of closely related organisms that are very similar to each other and are usually capable of interbreeding and producing fertile offspring.

The species is the fundamental category of taxonomic classification, ranking below a genus or subgenus.

The Importance of Invertebrates: Some Invertebrates Benefits:

1- Pollinators, Example honey bees .
2- Recyclers :recycling and processing of waste in the environment. Example (Dung Beetles).
3- Play a large role in Food webs it is shown that while different species of invertebrates can play the role of herbivores and carnivores in a food web, there are also many species of decomposer invertebrates that help to break down animal wastes and bodies of dead plants and animals.

4- Biological Control Agents: Uses invertebrate predators and parasitoids, so called natural enemies, for the sustainable reduction of pest populations, including other invertebrates and invasive plant species.
5- Provider of Goods: Sponges for bathing, Corals, Oysters and others for jewelry, Cloth production (silk).
6- Use as Food .
7- Medicinal benefits. Hirudin is a naturally occurring peptide in the salivary glands of blood-sucking leeches that has a blood anticoagulant property.
8- Invertebrates as model organisms for research. Example : Drosophila melanogaster (fruit fly).This fruit fly has approximately 15,500 genes on its four chromosomes, whereas humans have about 22,000 genes among their 23 chromosomes. .
9- Invertebrates as Bioindicators: Some invertebrate communities are often used as indicators of ecosystem health because many species are sensitive to pollution.

Some Harms of Invertebrates Disease :

1- Many invertebrates affected the agriculture production in field and stores.
2- Some invertebrates transmit and cause variable diseases to man and animals.

LAB. 2 Phylum: Protozoa :

Characteristics of Protozoan Phyla :

1. Unicellular; some colonial, and some with multicellular stages in their life cycles.
2. Mostly microscopic.
3. All symmetries represented in the group.
4. No germ layer present.
5-No organs or tissues, but specialized organelles are found; nucleus single or multiple.
6. Free-living, mutualism, commensalism, parasitism all represented in the groups.
7. Locomotion by pseudopodia, flagella, cilia, and direct cell movements; some sessile.
8. Some provided with a simple endoskeleton or exoskeleton, but most are naked. 9. Nutrition of all types: autotrophic, heterotrophic and saprozoic.
10. Aquatic or terrestrial habitat; free-living or symbiotic mode of life.
11. Reproduction asexually by fission, budding, and cysts and sexually by conjugation or by syngamy.

Classification of Protozoa:

Phylum: Protozoa

1. **Class: Flagellata:** As the name suggests, the members of this group have flagella. They can be free-living as well as parasitic

Order 1: Cryptomonadina ……. *Chilomonas*.

Order 2: Phytomonadina …… *Volvox.*

Order 3: Euglenoidina ……*Euglena.*

Order 4: Diplomonadina …….*Giardia.*

Order5: Opalinina …….. *Opalina.*

2. **Class: Sarcondina : –** They have pseudopodia (false feet) which help to change their shape and in capturing and engulfing food.

Order: Amoebina …… *Amoeba*

3. **Class: Sporozoa:** These organisms are so-called because their life cycle has a spore-like stage

Order 1: Gregarinida ……. *Monocystis*

Order 2: Coccidia …… *Plasmodium*

4. **Class: Ciliata:** They have cilia all over their body which help in locomotion as well as nutrition. They are always aquatic

Order: Holotricha ……*Paramecium – Didinium* .

Order : Peritrichida ---------- *Vorticella*

Order : Heterotrichida --------- *Stentor*

Class : Flagelata

Characteristic of Flagellata :

1- Have whip – like structures called flagella .

2- Locomotion through one or more flagella .

3- The body covered with pellicle and has definitive shape .

4-Nutrition may be Autotrophic, heterotrophic and saprozoic .

5-Asexual reproduction is by longitudinal binary fission .

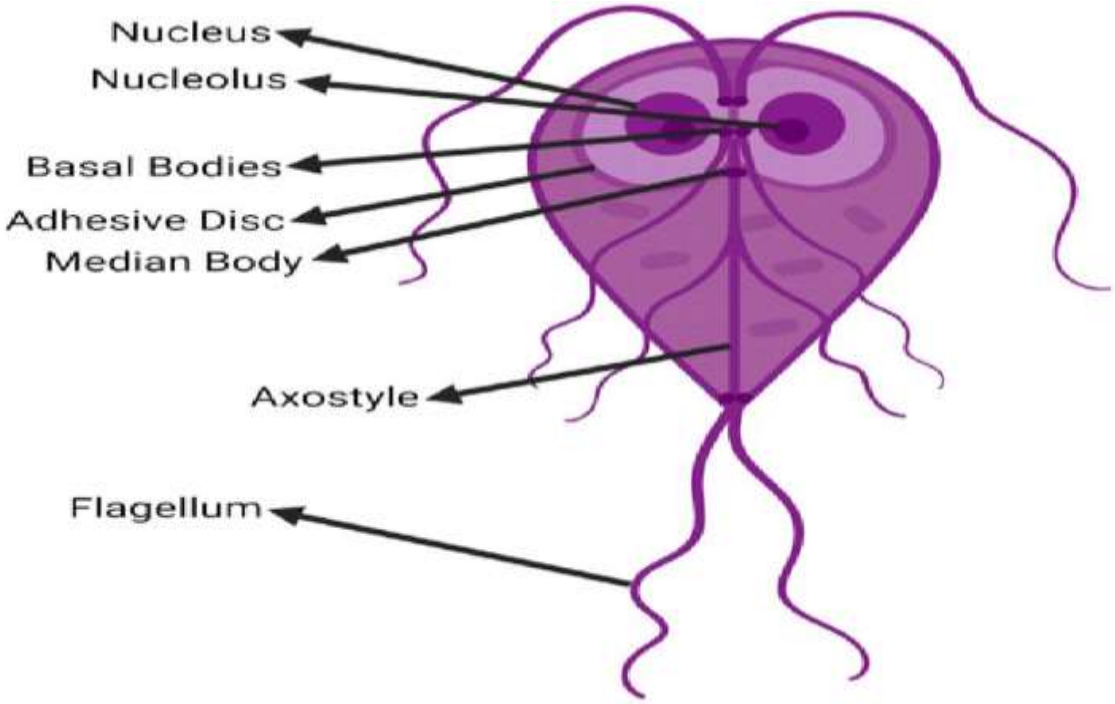
6-Mostly free living but some are parasites .

Chilomonas

1- Small size .
2- Does not have chloroplasts .
3- Cytoplasm include numerous polysaccharide granules .
4- Two equal flagella .
5- One contractile vacuole in the anterior part .
6- One nucleus in the posterior half .
7- Does not have cytosome .
8- Similar to Cryptomonas in general body form and structure, but **colorless**; without pyrenoid .

Giardia

1- There are four pairs of flagella.
2- Two nuclei with prominent central karyosomes.
3- Two axostyles (rod-like supporting organelles).
4- A large concave sucking disk in the anterior portion occupies much of the ventral surface.
5- Have two stage trophozoite & Cyst .



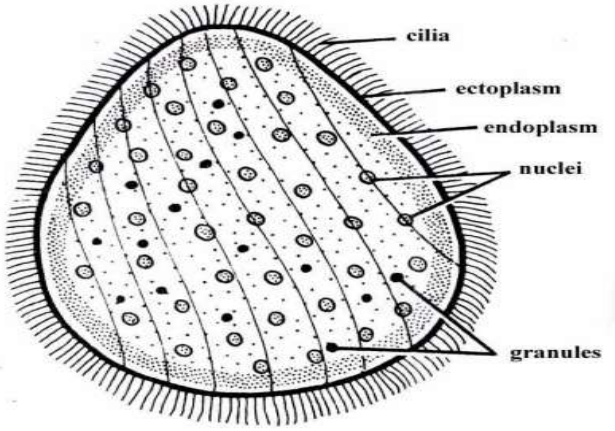
Opalina

1- The body is flattened, leaf-like

2- covered by thin pellicle.

3-Nutrition is by pinocytosis.

4-There are several small, spherical and similar sized nuclei present in the endoplasm.



10.12 Opalina

Opalina

Class : Sarcodina

Characteristic of Sarcodina :

1- They have a naked body, thus their shape is not rigid.

2- They use pseudopodia as locomotory appendage.

3- The cytoplasm is classified into an endo and ecto cytoplasm.

4- Contractile vesicles are present in nonpathogenic strains while they are absent in pathogenic strains.

5-Usually one nucleus is present .

6-Nutrition is holozoic .

7-Asexual reproduction is binary fission , multiple fission , budding and plasmotomy .

8- Sexual reproduction is copulation and conjucation .

Amoeba

1-Single cell surrounded by cell membrane .

2-Naked without skeleton .

3-Jelly – like cytoplasm and divided into endoplasm (near the nuclei membrane) and ectoplasm (near the cell membrane) .

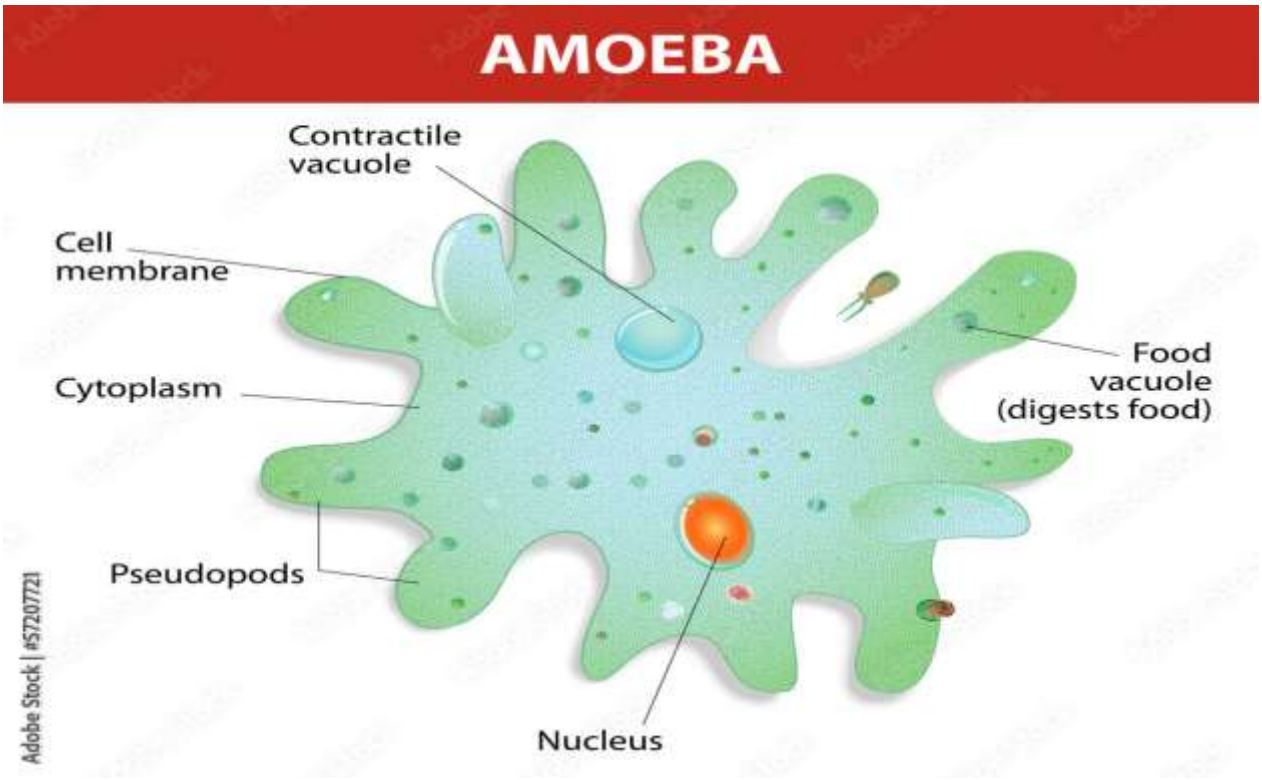
4-Have large nucleus controls its growth and reproduction .

5-Respiration and Excretion occurs by diffusion through general body surface.

6-Eukaryotic (they have a membrane enclosed nucleus) .

7-Moves by pseudopodia (lobopoda) uses to engulf its prey .

8-The contractile vacuole responsible for osmoregulation .



Class : Sporozoa

Characteristic of Sporozoa :

They are endoparasitic.

1- Sporozoans are organisms that are characterized by being one-celled, non-motile, parasitic, and spore-forming.

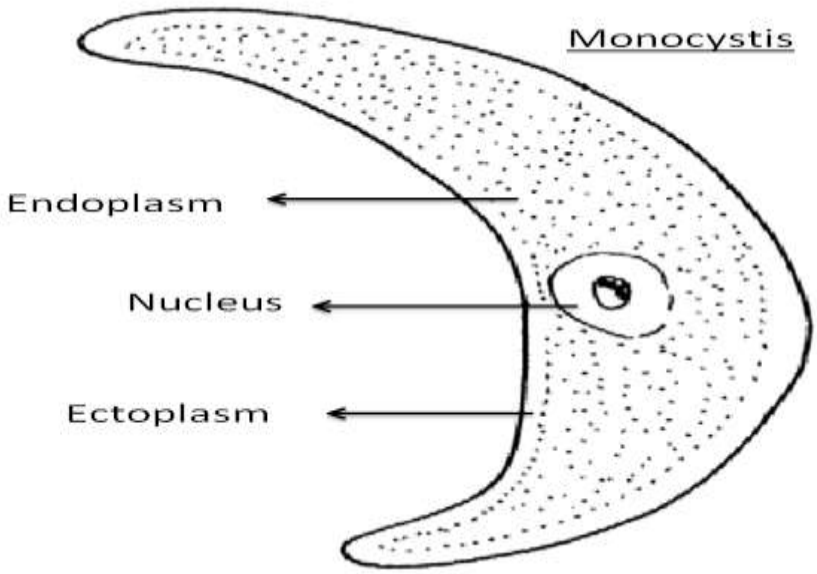
2- They don't have any specialised organ for locomotion

3- The pellicle is present, which has subpellicular microtubules, that help in movement.

4- Reproduction is by sporozoite formation .

Monocystis

1- The adult is an elongated, spindle-shaped, flattened, wormlike creature.
2- Its body is covered by a thick, smooth, and permeable pellicle.
3- The cytoplasm is well differentiated into ectoplasm and endoplasm .
4- the latter containing a large vesicular nucleus.
5- Its nutrition is sporozoic.



Class : Ciliata

General characteristic :

1-Complex protozoa with firm pellicle.

2-Locomotion by cilia.

3-Nuclei of 2 kinds. -Nutrition holozoic. –

4- Asexual reproduction by binary fission.

5 -Sexual reproduction by conjugation and autogmy.

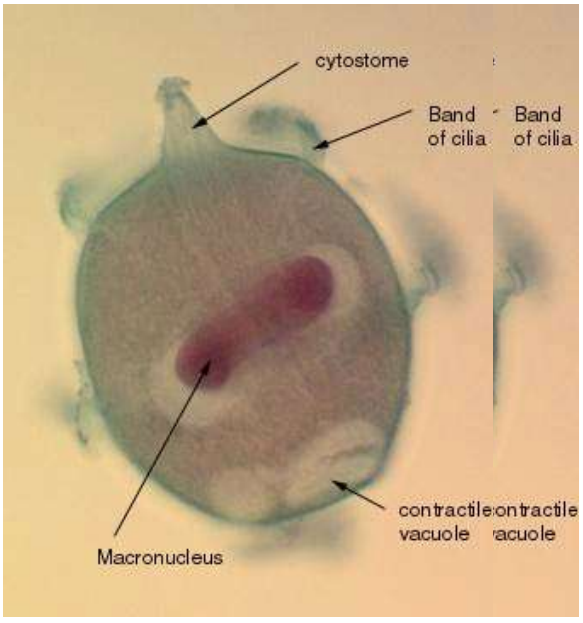
Didinium

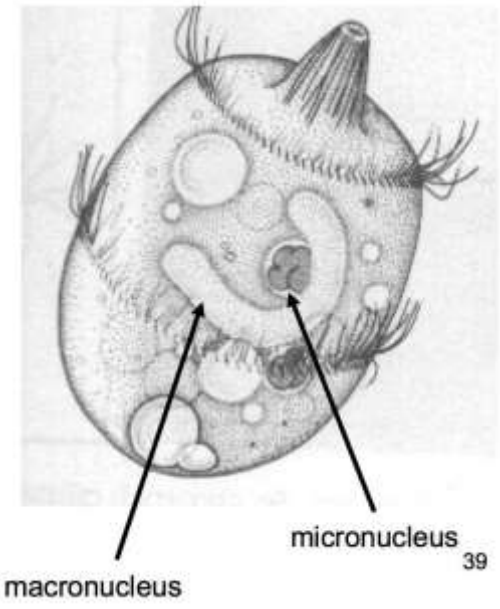
1-Unicellular and oval ciliated shape .

2-Have two sizes of nuclei (Macronucleus & Micronucleus) .

3-Cilia are arranged in bands around the body . One is located around the middle and other at the front .

4-The front ends in a pointed cytosome .



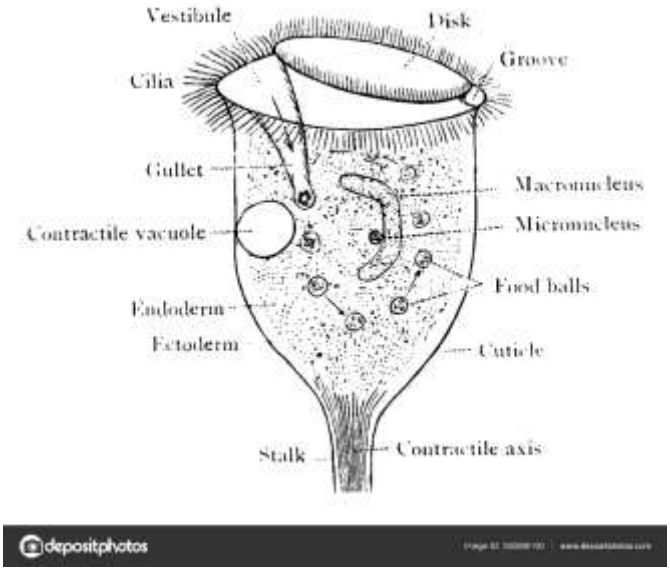


Vorticella

1-Bell- shaped or cylindrical organism with ring of cilia on the oral end .

2-Contractile stalk on the aboral end attached to the substrate .

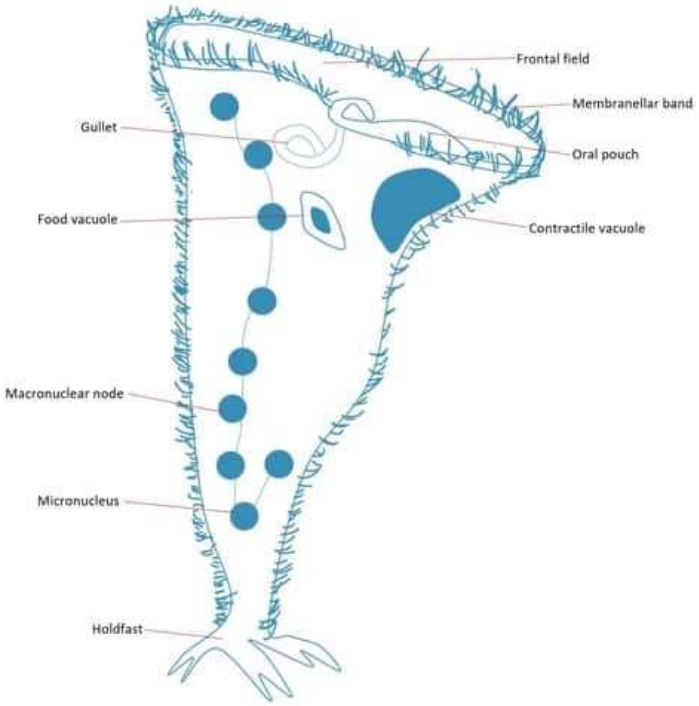
3-Usually two sizes of nuclei (Macronucleus & Micronucleus) .



Stentor

1- Stentor (also known as the “Trumpet Animalcule”) is a genus of the ciliate. They have a horn-shaped body with cilia uniformly cover the most surface area.

2- The contractile vacuole can be seen beneath the cell membrane and is also associated with scars in the membrane called contractile vacuole pores
3- The cell's macronucleus is stretched along its length and packaged into distinct nodes, giving it the appearance of 'beads on a string'.
4- They also swim by waving the cilia that cover their body.
5- They reproduce asexually through binary fission.
6- *Stentor* have a remarkable “regenerative capability”. Even a small fragment of an adult Stentor can grow back into a complete animal.



Stentor

LAB. 3 Phylum : Porifera

General Characteristics :

1. Multicellular; Body with pores (ostia), canals, and chambers that serve for passage of water.
2. The sponge has a large open cavity inside called the spongocoel , which is the water follow into , while the top opening called osculum .
3. Mostly marine; all aquatic.
4. Radial symmetry , they have varied shapes tube -like , barrel- like , cup- like , branched and irregular shapes all these shapes are structhred to provide optimal water flow .
5. Epidermis of flat pinacocytes; most interior surfaces lined with flagellated collar cells (choanocytes) that create water currents; a gelatinous protein matrix called (mesoglea) contains amebocytes of various types and skeletal elements.
6. Skeletal structure of fibrillar collagen (a protein) and calcareous or siliceous crystalline spicules, often combined with variously modified collagen (spongin).
7. No organs or true tissues; digestion intracellular; excretion and respiration by diffusion.
8. All adults sessile and attached to substratum.
9. Asexual reproduction by Redaction bodies , buds and gemmules , while sexual reproduction by eggs and sperm .

Classification

Phylum: Porifera

1. Class: Calcarea

Order: Homocoela …….. *Leucosolenia*

Order: Heterocoela …….*Sycon*

2. **Class: Hexiactinellida (Glass sponges)**------- *Euplectella*

3. **Class: Demosponges**---------- *Spongilla*

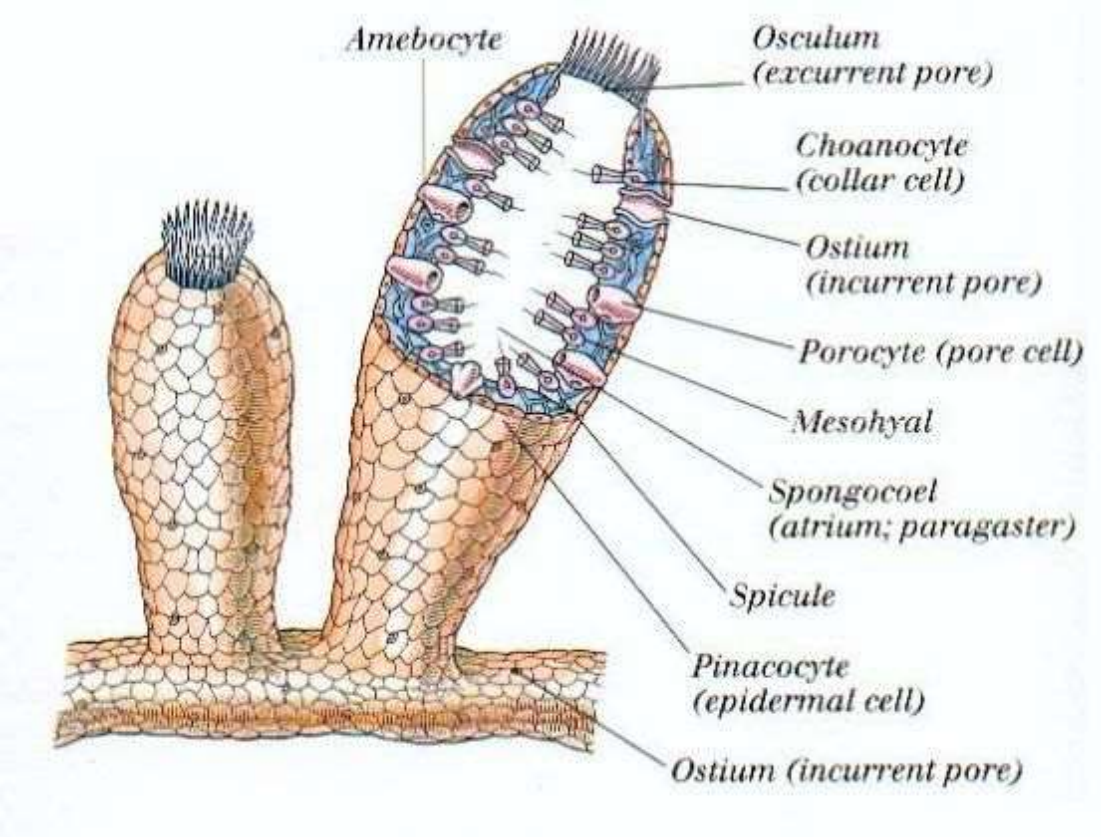
Class : Calcarea

1-These are small size sponges .

2- Solitary or Clonial .

3-Body cylindrical or vase like in shape .

4-Skeleton formed of calcareous spicules which may be one ,three or four rayed.



Leucosolenia

1- The whole colony looks like curved vases or a bunch of bananas.

2- The central cavity is the spongocoel through which water enters via numerous perforations and exits through one large opening called an osculum which is present at the tip.

3- The central cavity is lined by cells called choanocytes. They have flagella attached that creates a water current.

4- The outer body wall of the genus is lined by flat and thin cells called pinacocytes.

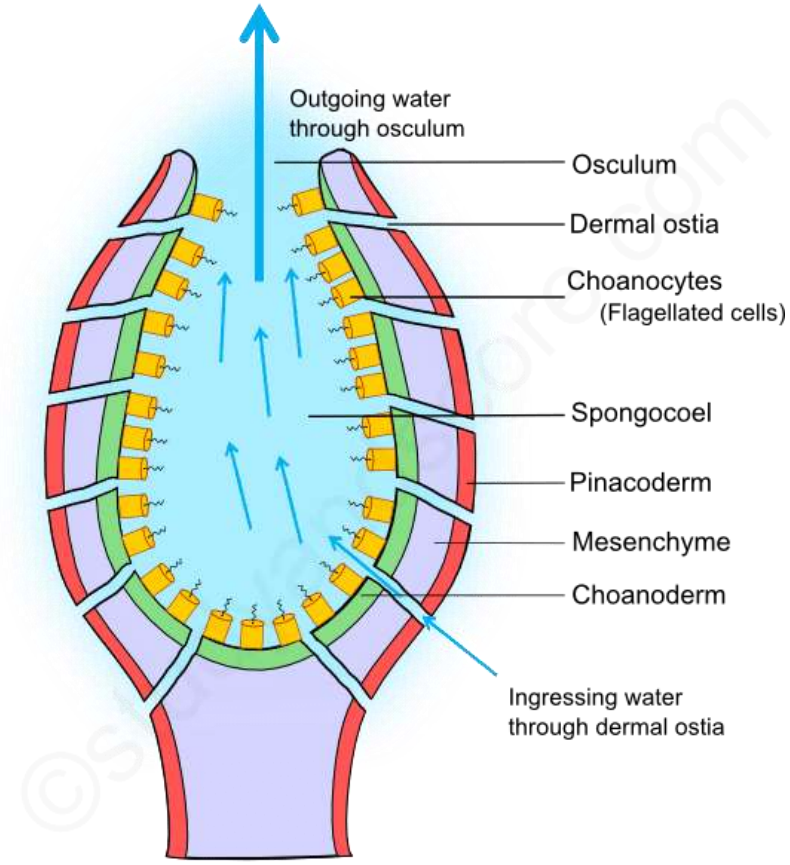
5- Between the two layers is a layer of jelly-like substance called mesoglea that consists of moving cells (amoebocytes) and skeletal spicules.

6- The skeletal spicules are thin, three or four pointed star-like structures which provide support to the body tube. The spicules are produced by the amoebocytes.

7- Asexual reproduction is by means of budding and branching , while sexual reproduction in *Leucosolenia* occurs by the production of gametes, ovum and spermatozoa .

8- Canal system is the simplest type , water inters through :

Water from outside → Ostia → Spongocoel → Osculum → Out of the body .



Ascon type canal system (Ex: Leucosolenia)

Sycon

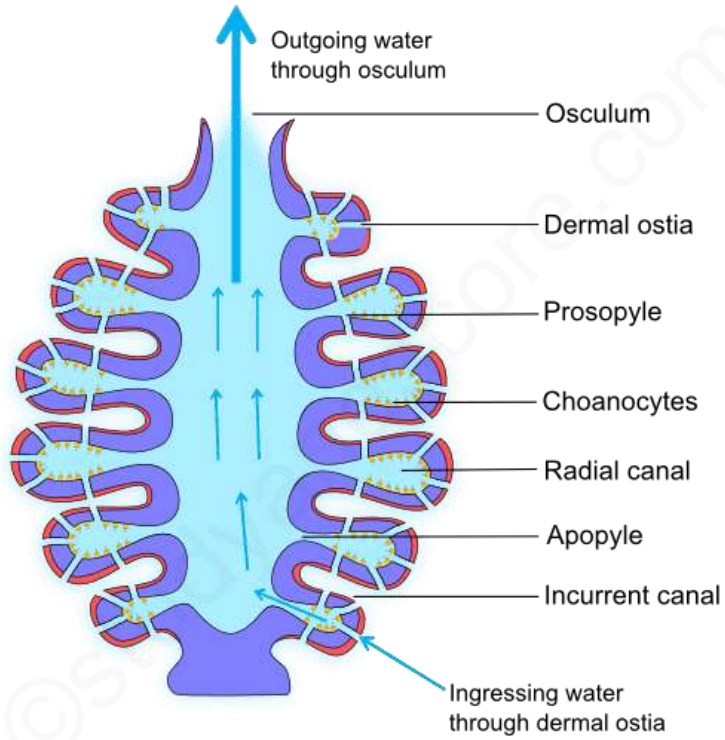
1-Complex vase shaped body .

2-At the distal free end there is a large osculum encircled by monaxon spicules forming funnel shaped collar or oscular fringe .

3-Choanocytes are restricted to radial canals .

4-Canal system is syconoid type , water inters through :

Water from outside → Dermal pores → Incurrent canal → Prosopyle → Radial canals → Apopyles → →Spongocoel → Osculum → Out of the body .



Sycon type canal system (Ex: Scypha)

Class : Hexiactinellida

1-Its body cylindrical , funnel shaped or cup shaped , medium sized but some reached one meter in length .

2-Its commonly known as glass sponges .

3-The canal system is Syconoid type .

4-Thy found in deep marine water .

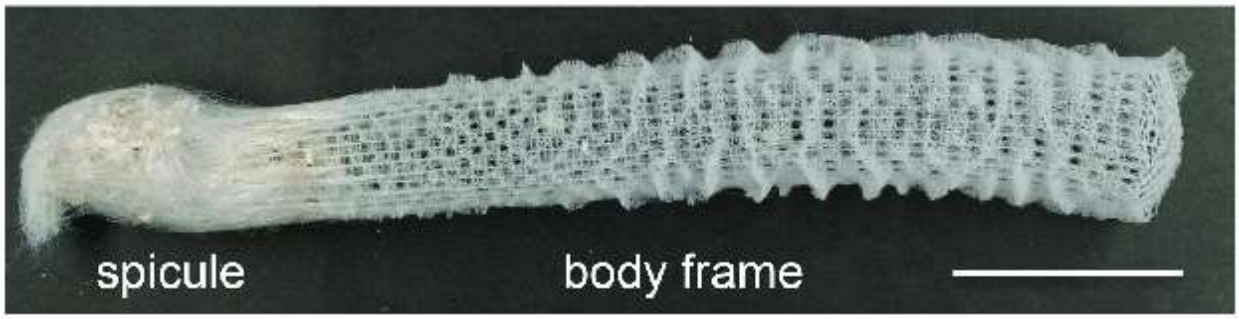
Euplectella

1-Commonly called as (Venus's flower basket) due to its beautiful elegant glossy shape like knitted elongated basket .

2-Body is long , rigidly curved and cylindrical .

3-Spicules are joined together forming a network .

4-Osculum is closed in above with a sieve plate .



Class: Demospongiae

1-Solitary or Clonial .

2-Its body is cup or vase shape , showed both small and large size .

3-Spicules are seen monaxon or tetraxon .

4-The canal system is leuconoid type .

Spongilla

1-Commonly known as fresh water sponge .

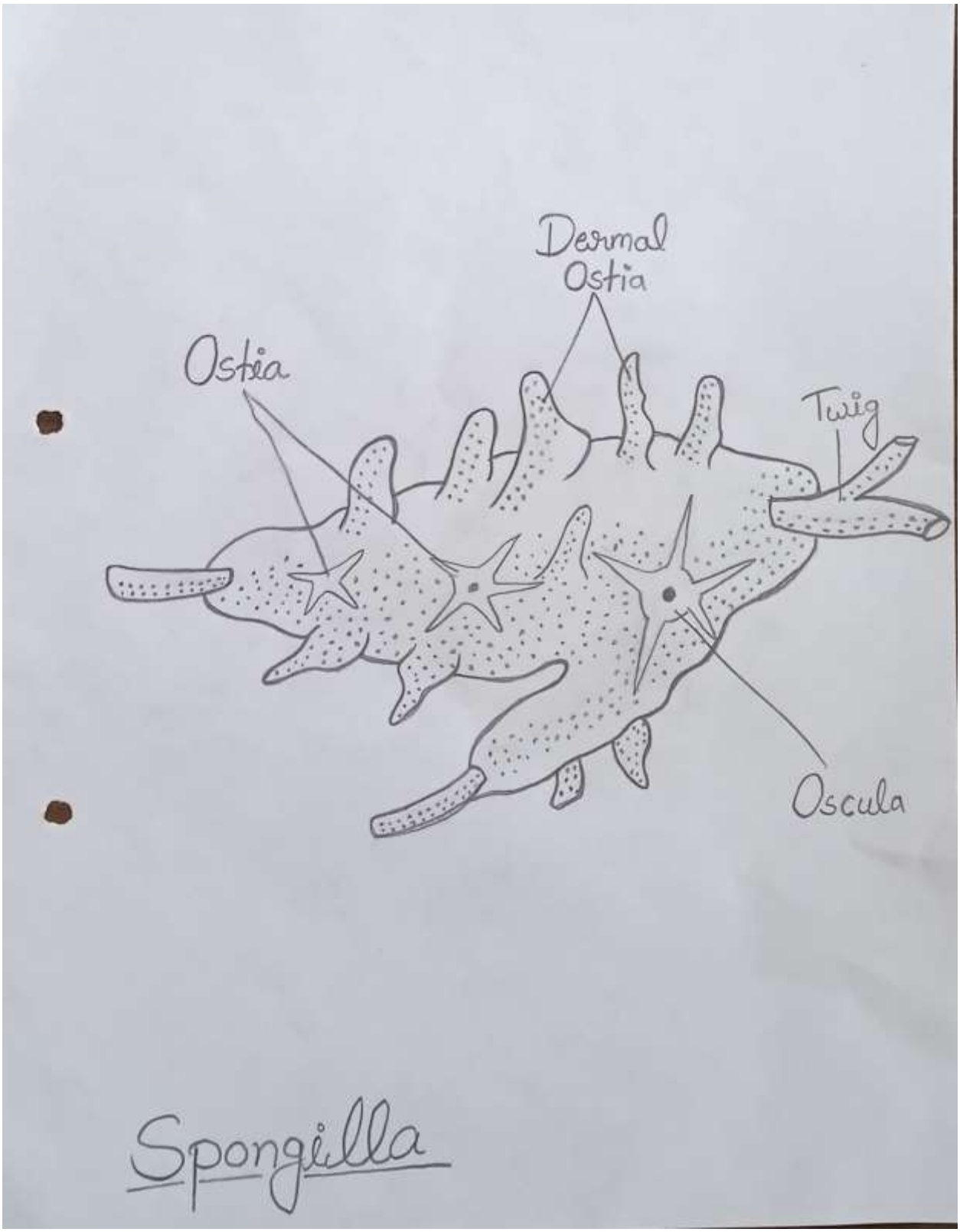
2-Body wall consists of very thin dermal layer , perforated with dermal pores or ostia .

3-Skeleton is composed of sponging fibers , the siliceous spicules are in the form of network embedded in the sponging .

4-Choanocytes are restricted to flagellated chamber .

5-Canal system is leconoid type water inter through .

Water from outside → Dermal pores → Subdermal spaces →Incurrent canal → Prosopyle → Flagellate chambers → Apopyles → Excurrent channels →Spongocoel(very narrow) → Osculum → Out of the body .


Dermal
Ostia
Ostia
Twig
Oscula
Spongilla

LAB. 4 Phylum: Cnidaria or Coelenterata

General characterizes of Cnidaria

1. Entirely aquatic, some in fresh water but mostly marine.

2. Radial symmetry .

3. Two basic types of individuals: polyps and medusa.

4. Exoskeleton or endoskeleton of chitinous, calcareous, or protein components in some.

5. Body with two layers, epidermis and gastrodermis, with mesoglea (diploblastic). in some (triploblastic).

6. Gastrovascular cavity with a single opening that serves as both mouth and anus.

7. Special stinging cell organelles called nematocysts .

8. Nerve net with symmetrical and asymmetrical synapses; with some sensory organs; diffuse conduction.

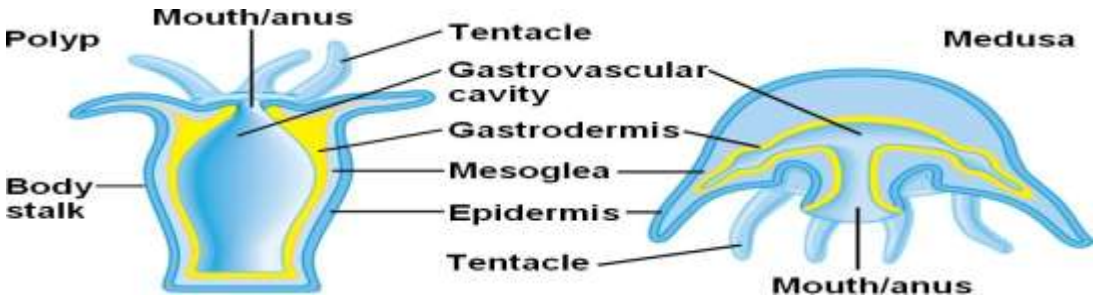
9. Muscular system of an outer layer of longitudinal fibers at base of epidermis and an inner one of circular fibers at base of gastrodermis.

10. Asexual reproduction by budding (in polyps) or sexual reproduction by gametes (in all medusae and some polyps).

11. No excretory or respiratory system and no coelomic cavity.

Different between Polyp & Medusa :

Polyp	Medusa
Sessile	Free swimming .
Body cylindrically elongated .	Body umbrella – like , unverted bowl or bell .
Tentacles are usually 24	16 tentacles in young medusa .
Mesoglea poorly development .	Mesoglea well development .
Sens organs are absent .	Sens organs are present .
Mouth located at upper side .	Mouth located at lower side .
Velum is absent .	Velum is present around the margins of the shape .
Reproduces asexually .	Reproduces sexually .



Classification of Cnidaria

Phylum: Cnidaria

1. Class: Hydrozoa …….. *Hydra – Obelia* .

– Most are marine a few are freshwater.

– Individuals usually small and inconspicuous.

– Polyp is dominant stage, some completely lack medusa.

– Medusa when present has velum around margin.

– Most are colonial – small plant like appearance.

– Most have polymorphism with alternation generation.

Obelia

1-Lives in marine as colonies .

2-It has both polyp and medusa stages in their life cycle .

3-During the polyp stage , the *Obelia* takes on stalk – like structure which is covered by protective perisarc .

4-The polyp reproduces asexually , releasing free swimming ciliated medusa .

5- Medusa release sperm or eggs into the surrounding water, and the resulting ciliated larva eventually metamorphoses to produce a branching colony of polyps.

6-Polyp consists of two types , feeding polyp (gastrozooid) and reproductive polyp (gonozooid) .

7-The polyp reproduce asexually while the free swimming medusa reproduce sexually .

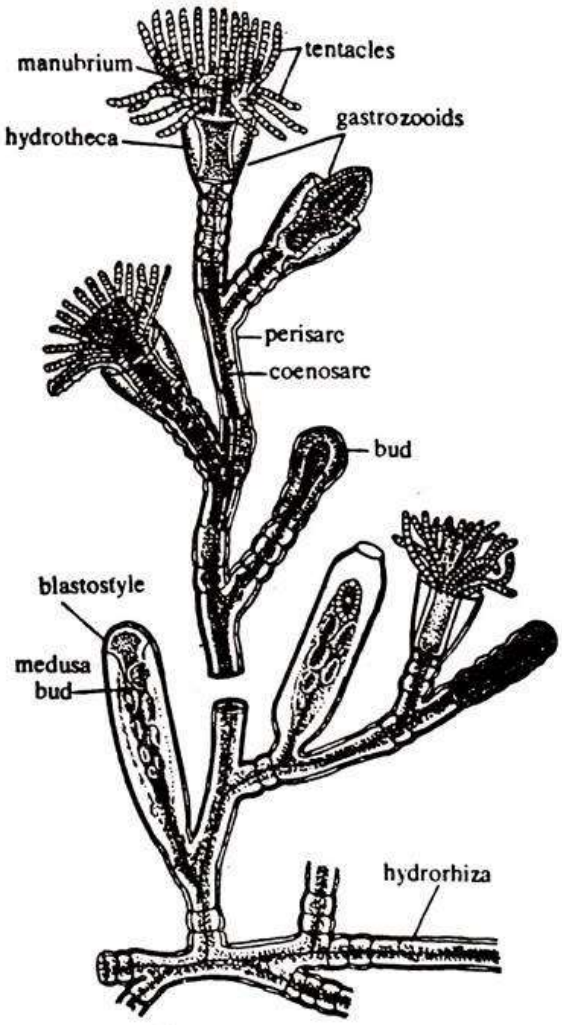


Fig. 20.12. Obelia geniculata

Obelia

2. Class: Scyphozoa ……*Aurellia*

- Most of larger Jellyfish belong to this group.
- Medusa without velum, cells in Mesoglea.
- All of them are marine and solitary forms .
- Medusa stage is dominant but polyp stage reduced or absent .
- The gonads are gastro – dermal and sex cells are shed or released in digestive cavity .

Aurellia (Jelly fish)

1-Medusa umbrella shaped .

2- tentacles used for capturing and stinging prey , oral arms used to bring food in to the mouth .

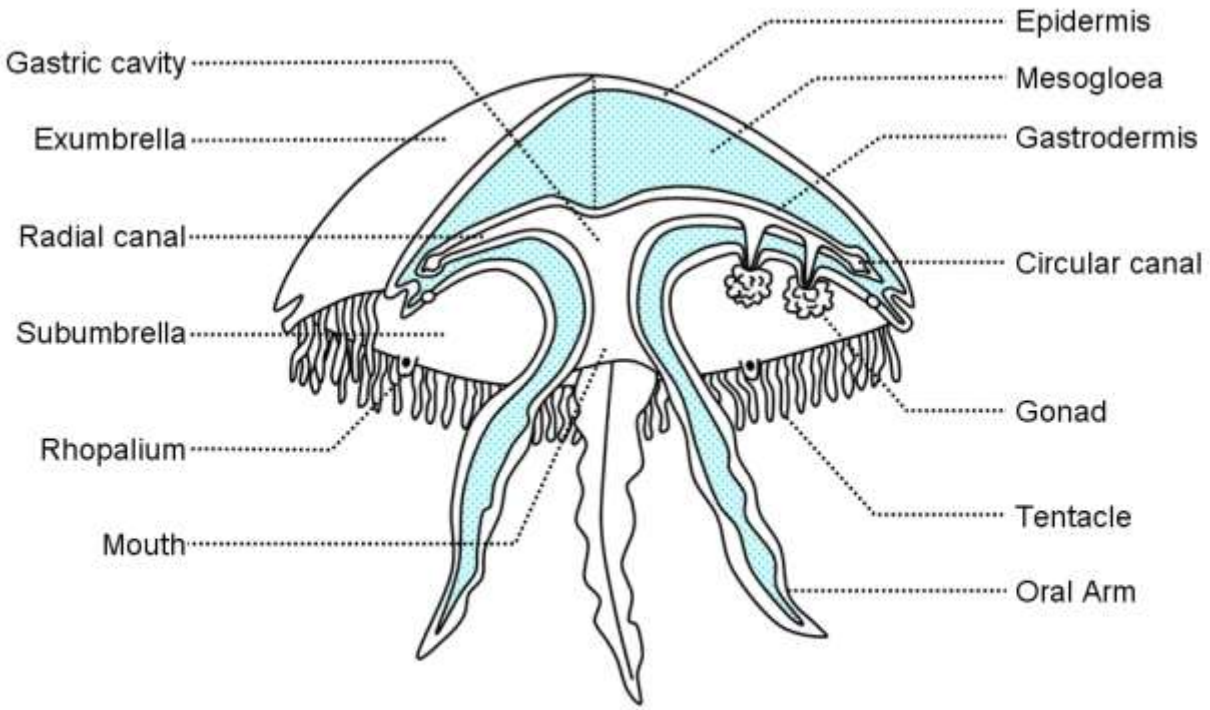
3-Has complex life cycle which includes the adult medusa that produces egg and sperms that are fertilized externally .

4-The fertilized egg develops into a planula larva , larva is free swimming and spends some time moving finally it settles and change into a polyp form called scyphistoma .

5-Scyphistoma buds to forms a complex structure called the strobilus .

6-Strobilus buds off young , immature medusa called ephyrae , which mature into the adult jellyfish .

7-This is known as alternation of generation (metagenesis) .



Aurelia medusa – cutaway diagram

3. Class: Anthozoa …….. *Corallium*

1-They are exclusively marine m may be solitary or colonial .

2-All are polyp forms no medusa .

3-They have gastro – dermal gonads .

4-Skeleton either external or internal .

5-Nervous system prepared by typical nerve net without a concentrated central nervous system .

6-Fertilisation is external .

Corallium

1-Colony usually of plant like branching forms bearing short polyp .

2-Axial skeleton composed of horn .

3-It is commonly known as sea fans .

4-Separate or fused calcareous spicules or both .

LAB. 5 Platyhelminthes (Flatworms)

General attributes:

1. Three germ layers (triploblastic).
2. Bilateral symmetry.
3. Body flattened dorsoventrally.
4. Epidermis may be cellular or syncytial.
5. Muscular system primarily of a sheath form and of mesodermal origin; layers of circular, longitudinal, and sometimes oblique fibers beneath the epidermis.
6. Digestive system incomplete or absent in some.
7. Nervous system consisting of a pair of anterior ganglia with longitudinal nerve cords connected by transverse nerves so that's the shape of that system is ladder like .
8. Simple sense organs; eyespots in some.
9. Excretory system of two lateral canals with branches bearing flame cells.
10. Respiratory, circulatory, and skeletal systems lacking.
11. Most forms monoecious , sperm has two flagella .

1- CLASS I: TURBELLARIA :

1. Mostly free - living forms found in fresh or sea waters or on land.
2. Body is unsegmented and is dorsiventrally flattened.
3. Epidermis is cellular or syncytial.

4 Intestine is either absent or simple and sac or branched.

5- Order : Tricladida : Dorsiventrally flat body is seen. Intestine has two lateral limbs and one median limb Genital aperture is single. Ex: ***Planaria.***

Planaria

1- *Planaria* are common to many parts of the words living in both saltwater and freshwater ponds and rivers some species are terrestrial .

2- *Planaria* has a soft, flat, wedge- shaped body that may be black, brown, blue, gray or white.

3- The blunt, triangular head has two Ocelli (eyespots) pigmented areas that are sensitive to light. There are two auricles (earlike projections) at the base of the head which are sensitive to touch and the presence of certain chemicals .

4- Digestive system contain from mouth , pharynx and gastro vascular cavity the last branches throughout the body allowing nutrients from food to reach all extremities .

5- Nervous system is contain from ganglia (brain) , many transverse nerves connected to the nerve cords extending from the brain, which makes the nerve system look like a ladder .

6- The excretory system is made of many tubes with many flame cells and excretory pores on them .

7- There are sexual and asexual *Planaria.* Sexual *Planaria* is hermaphrodites, possessing both testicles and ovaries while asexual reproduction, the *Planaria* detaches its tail end and each half regrows the lost parts by regeneration .

2-CLASS: TERMATODA :

1.These are commonly known as flukes.

2.These are ectoparasitic or endoparasitic forms.

3. Body is unsegmented and enlongated.

4.Adhesive organs are, one or two suckers without hooks and spines.

5. Digestive tract is bifurcated and highly diverticulated. Anus is absent.

6. Contain from two orders : 1-Monogenea ------- Ex : ***Polystoma.***

2-Order: Digenea : Ex : ***Fasciola hepatica .***

Polystoma

1- Is a leaf-like.

2- At the anterior (head) end are the mouth and a pair of suckers, and at the posterior end is the main device by which the parasite attaches to its host, the opisthaptor .

3- Three pairs of suckers, a pair of hooked anchors and marginal hooks.

4- The flatworm's mouth is connected to a muscular pharynx, an oesophagus and a gut, but it has no anus .

3- CLASS 3 :CESTODA:

1.Totally endoparasitic forms.

2. Body covered with thick cuticle.

3.Mouth,digestive tract and sense organs are absent.

4.Fertilization is internal.

Contain two sub – class :

1-Sub -class I : Cestodaria or Monozoa --------- Ex: ***Amphilina .***

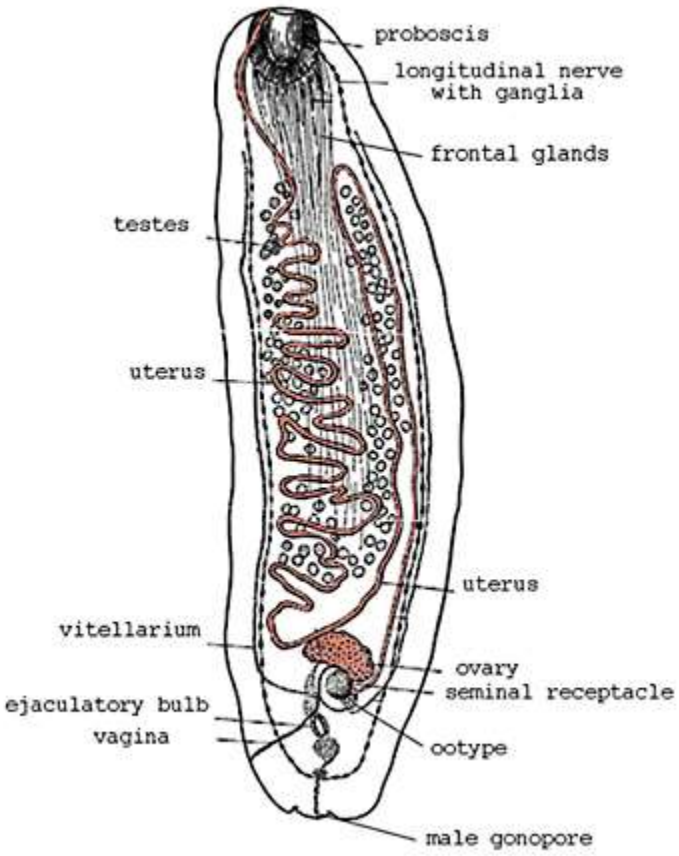
2-Sub - class 2 : Eucestoda (or) Merozoa-------- Ex: ***Taenia .***

Amphilina

1- True tapeworms (Eucestoda) as their bodies are unsegmented and not divided into proglottids.

2- Large worms which have a flattened leaf-like body.

3- The adults are hermaphroditic.



LAB. 6 Phylum :Annelida

Characteristics of Annelida

1. Symmetry bilateral and triploblastic.
2. Their body is segmented (metameric) . Each segment is separated by internal body walls called septa.
3. The Annelida body contains three main body regions:

   A) The prostomium, or the head

   B) The trunk, or main body

   C) The pygidium, the anus.

   Note: The first segment behind the prostomium is called the periosteum, which surrounds the mouth of the worm

   While the last segment of the body before the pygidium is the growth zone, where new segments are added as the worm grows.

4. Organs of the Locomotory are chitinous bristles on each segment called **setae or Chaetae** that give them traction when they crawl. Some also have fleshy appendages called **parapodia** which can be differentiated specialized for movement or respiration.
5. Nephridia are the excretory organs.
6. Digestive system complete and not metamerically arranged.
7. Circulatory system closed and segmentally arranged; respiratory pigments (hemoglobin, hemerythrin) often present; amebocytes in blood plasma.
8. Regeneration is a very common characteristic of the Annelids.
9. Respiratory gas exchange through skin, gills, or parapodia.

10. Excretory system typically a pair of nephridia for each metamere.

11 . Nervous system with a double ventral nerve cord and a pair of ganglia with lateral nerves in each metamere; brain a pair of dorsal cerebral ganglia with connectives to cord .

12. Hermaphroditic or separate sexes; larvae, if present, are trochophore type; asexual reproduction by budding in some.

13-Sensory system of tactile organs, taste buds, Statocysts (in some), photoreceptor cells, and eyes with lenses (in some); specialization of head region into differentiated organs, such as tentacles, pals, and eye spots of polychaetes.

14-Most of the Annelids are hermaphrodite, i.e., male and female organs are present in the same body. They reproduce both sexually and asexually. The others reproduce sexually.

15 -Annelids have 3 general types of movements:

1. Burrowing
   Waves of peristaltic contractions sweep down body (contraction of circular and contraction of longitudinal muscle)

2. Crawling Polychaetes use parapodia alternately to move.

3. Swimming

Classification of Annelida

Following are the different classification of Annelida:

- Class:Polychaeta
- Class:Oligochaeta
- Class:Hirudinea

- Class:Archiannelida

1-**Class :Polychaeta**

- The body is elongated and divided into segments.
- They are found in the marine environment.
- These are true coelomates, bilaterally symmetrical worms.
- They excrete through metanephridia and protonephridia.
- Fertilization is external.
- They have a well-developed nervous system.
- The circulatory system is closed type.
- They are hermaphrodites.
- They might possess fin-like appendages called parapodia.
- The organisms belonging to this group lack clitellum and are dioecious.
- Eg., *Nereis, Syllis* .

Nereis

1- Common Name Rag worm or clamworm , Cylindrical , adult reach between 12-20 cm in length having 80 – 120 segments .

2-Well development head has prostomium and peristomium .

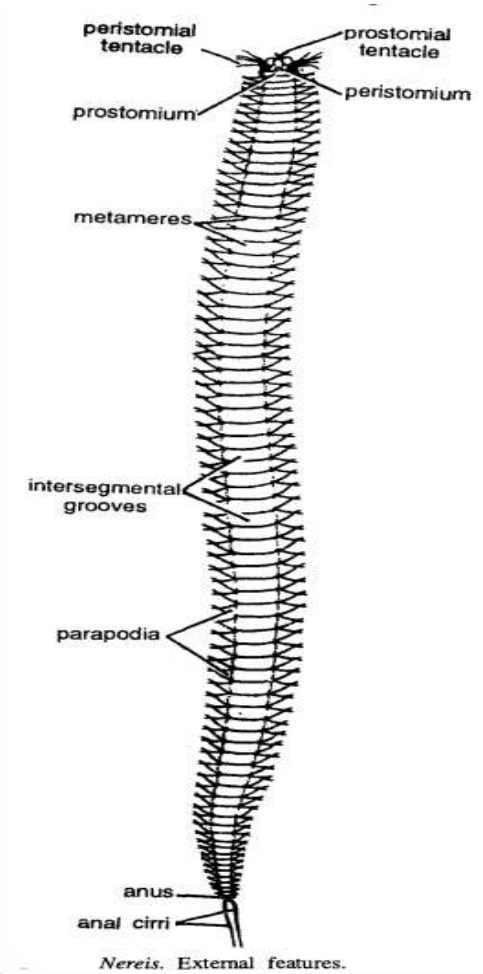
3-Prostomium bears a pair of palps sensitive to touch and taste , a pair of short sensory tentacles , and two small dorsal eyes sensitive to light .

4-Peristomium has a ventral mouth , a pair of jaws and four pairs of sensory tentacles (tentacular cirri) .

5-Each metameric has pair of fleshy lateral out growth of the body wall known as parapodium used for movement , swimming and respiration .

6-Prapodium contain from dorsal cirri , ventral cirri , notopodium (form dorsal part of parapodium) and neuropodium (form lower part of parapodium) .

7-Sexes separate (diocious) and free swimming ciliated trochophore larva .



Nereis. External features.

2-Class: **Oligochaeta**

- They are mostly freshwater and terrestrial organisms.
- The body is segmented metamerically.
- Head, eyes and tentacles are not distinct.
- They are hermaphrodites, but cross-fertilization takes place.
- Fertilization is external.
- Cocoon formation occurs.
- Setae are segmented.
- They do not possess parapodia but clitellum is present.
- The organisms belonging to class are monoecious.
- They exhibit no free larval stage and the development takes place inside the cocoons. this
- Eg., *Pheretima* , *Tubifex* .

Tubifex

1- alled the **sludge worm,** is a species of tubificid segmented worm that inhabits the sediments of lakes and rivers on several continents , The worms can survive without oxygen for months, and can survive in areas so heavily polluted with organic matter that almost no other species can endure.
2- This species has short, tub-shaped granular penis sheaths.
3- They are hermaphrodite worms .

3-Class: Hirudinea

- Most commonly found in freshwater. Some are marine, terrestrial, and parasitic.
- The body is segmented.
- The tentacles, parapodia, and setae are not present.
- The animals are monoecious.
- They have an anterior and posterior sucker on the ventral side.
- The organisms lay eggs in cocoons.
- There is no larval stage during the development of the organism.
- The mouth is located ventrally in the anterior sucker, while the anus is present dorsally in the posterior sucker.
- Fertilization is internal.
- They are hermaphrodites.
- Eg., *Hirudina*

4-Class: Archiannelida

- They are found only in the marine environment.
- The body is elongated without setae and parapodia.
- They are unisexual or hermaphrodite.
- Tentacles are present on the prostomium.
- Eg., *Dinophilus, Protodrilus*.

LAB. 7 Phylum : Arthropoda

Characteristics of Phylum Arthropoda

1. Triploblastic animal with Bilateral symmetry; metameric body (external metamerism) divided into tagmata consisting of head, thorax, and abdomen; or cephalothorax and abdomen .

2. Jointed appendages; primitively, one pair to each somite, these appendages give arthropods generalized appendages which were modified, specialized and adapted for: • Locomotion: (walking legs, tails and wings) • Feeding: (mouth parts and pincers) • Sensory reception: (antennae) • Defense: (pincers, stingers) .

3. Body is covered with exoskeleton made of chitinous cuticle which is often hard, but it is flexible in trunk and limbs to provide moveable joints. This exoskeleton is secreted by underlying epidermis and shed (molted) at intervals. The presence of thick cuticle prevents the water loss, and enabled arthropod to invade land, so arthropod regard the only invertebrates which have adapted to live on land on a high level scale.

4. Complex muscular system.

5. Reduced coelom in adult; most of body cavity consisting of haemocoel (sinuses) filled with blood.

6. Complete digestive system; starts with mouth and ends with anus.

7. Open circulatory system, with dorsal heart and arteries but without capillaries.

8. Respiration by body surface, gills, tracheae (air tubes), or book lungs.

9. Paired excretory glands called coxal green, or maxillary glands, some with other excretory organs, called Malpighian.

10. Nervous system has paired dorsal ganglia over the mouth, with connectives to a pair of ventral nerve cords.

11. Sexes usually separate, with paired reproductive organs and ducts; usually internal fertilization; oviparous or ovoviviparous.

12. Cilia are entirely absent from all parts of the body.

Classification of Arthropoda

Arthropoda can be classified in to four sub phyla :

1. Sub phylum: Onychophora ------ *Peripatus*.

2. Sub phylum :Trilobitomorpha ------ *Olenus* .

3. Sub phylum : Mandibulata

a- Class: Crustacea ------ *Daphnia* , *Cyclops* , *Cypris* .

b- Class: Insecta -------- *Anopheles* .

c- Class: Diplopoda ------ *Julus* .

4. Sub phylum :Chelicerata

a- Class: Arachnida ------ *Buthus* - *Argiope*

b-Class : Tardigrada ------ *Milnesium*

1. Sub phylum: Onychophora

Characteristic of Onychophora :

1. Body shows no or indistinct external segmentation.
2. Antennae not homologous .
3. Three segmented head.
4. Restriction of mandibles to a single pair.
5. Irregular distribution of spiracles or tracheal openings.

Peripatus.

1- It is a terrestrial animal, found living in moist places such as crevices of rock, under bark, under fallen leave and damp places and feed on small intestine for instance, snails, insects and worms .

2- The body of this animal is characterised by its caterpillar-like with soft and bilateral symmetry. Its length ranged from 1.4 cm – 15 cm.

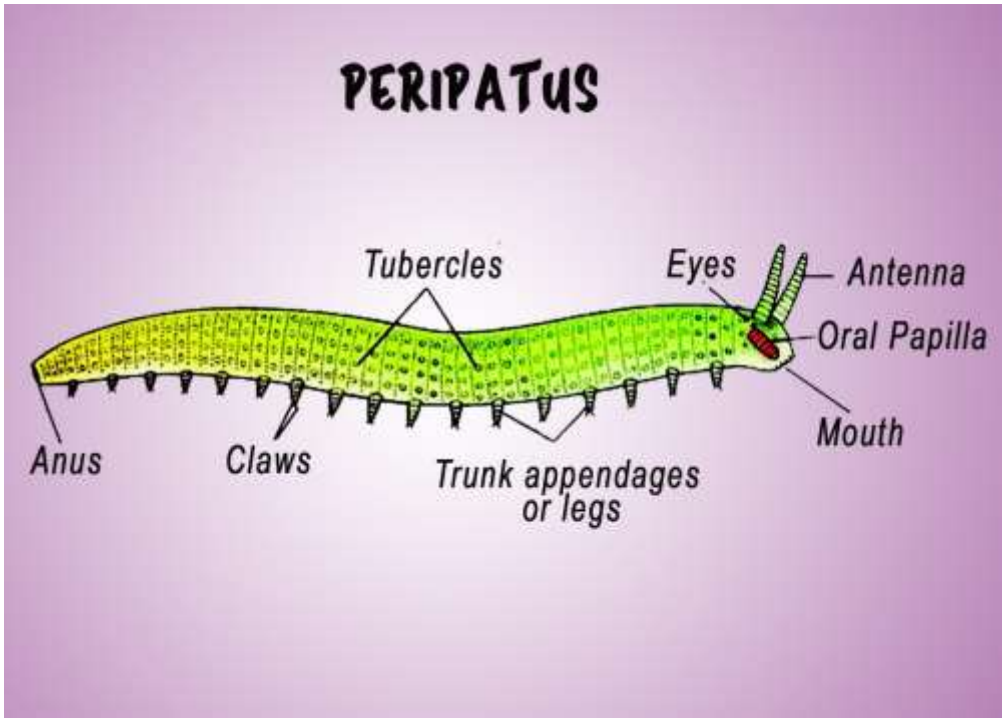
3- the head of Peripatus bears a pair of simple and dorsal eyes, a pair of antennae which represent the first pair of appendages, a pair of jaws or mandibles which represent the second pair of appendages, and a pair of oral papillae which regarded as a third pair of appendages, and found on both sides of head .

4- The trunk is lacking of exoskeletal covering, and its skin has many papillae like ridges. It posses appendages or legs which differ in number from 14-43 pairs depending on the species and sex. Each leg consists of two main divisions, the leg and foot.

5- Slime glands located on each side of the body cavity, and open on the oral papillae. When disturbed by a predator, the animal can eject from the slime glands two streams of a sticky substance that rapidly hardens.

6- The mouth, surrounded by lobes of skin, contains a dorsal tooth and a pair of lateral mandibles for grasping and cutting prey. There is a muscular pharynx and a straight digestive tract.

7- Each segment contains a pair of nephridia, each nephridium with a vesicle, ciliated funnel and duct, and nephridiopore opening at the base of a leg.



Sub phylum :Trilobitomorpha

1. Their exoskeleton contained chitin, strengthened in some areas by calcium carbonate.

2. There were three tagmata in the body: head, thorax, and pygidium.

3. Their head was one piece.

4. Two longitudinal furrows divided the body longitudinally.

5. Their thorax had a variable number of somites; and the somites of the pygidium, at the posterior end, were fused into a plate.

6. Their head bears a pair of antennae, compound eyes, mouth, and four pairs of jointed appendages.

7. Each body somite except the last one also bear a pair of biramous (two-branched) appendages. One of the branches had a fringe of filaments that may have served as gills.

3. Sub phylum : Mandibulata

A- Class: Crustacea :

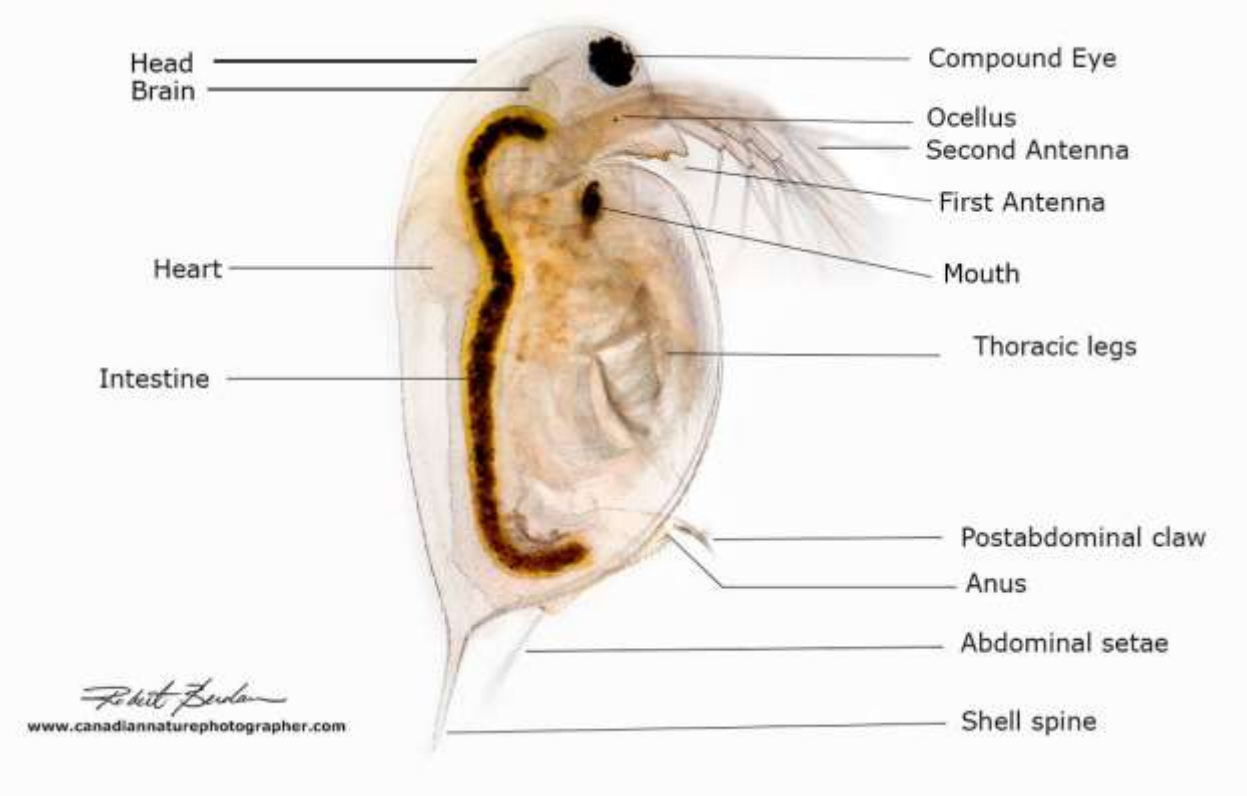
- Body divided into cephalothorax (head+thorax) and abdomen.
- The length of crustacea ranged from less than a millimetre to 4 metres.
- Crustaceans are the only arthropods with two pairs of antennae.

- A pair of mandibles and two pairs of maxillae on the head, followed by a pair of appendages on each body segment or somite. All appendages, except the first antennae, are primitively biramous (two main branches).

- Respiration by gills or body surface.

Daphnia

1- *Daphnia* ranges from 0.5mm to 1cm long , the body has a ventral gap in which the pairs of legs lie.
2- Their outer carapace is transparent, so many internal organs can be seen, even the beating heart.
3- On the head there is a compound eye and a pair of antennae, which are used for swimming.
4- Females are usually larger than males and have a brood chamber under their outer carapace where eggs are carried.
5- Daphnia uses its third pair legs to filter the water , Daphnia's food of unicellular algae, protists and bacteria into their digestive tract.
6- Most *Daphnia* species have a life cycle alternates between asexual (***Parthenogenic)*** reproduction and sexual reproduction.



Cyclops

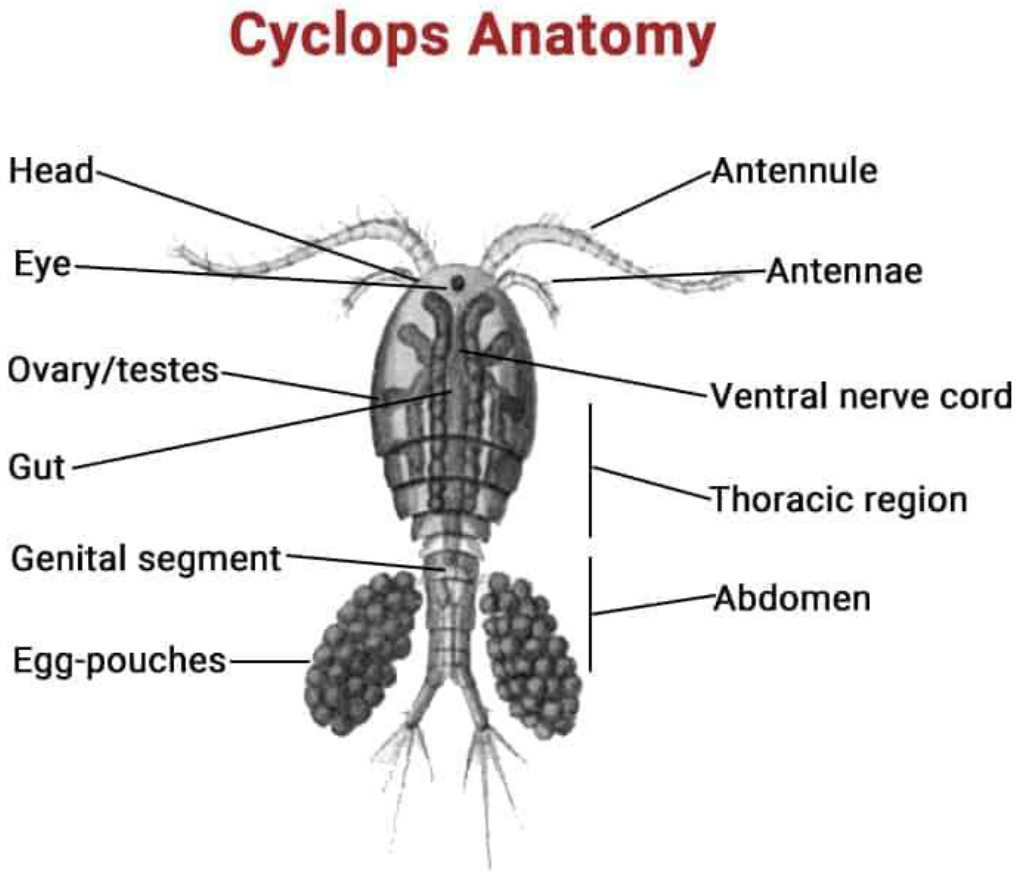
1-Named one – eyed monster , Pear shape or elongated , body 1.5 – 5 mm in length .

2-Hard outer shell .

3-Head and first thoracic segment become fused to form cephalothorax which covered dorsally by carapace .

4-It is has 5 pair of legs and a divided tail – like appendages called a furcal .

5- The female carry the eggs in little side sacs and they multiply rapidly.



Sub phylum :Chelicerata

- They have no head.
- Only one pair of mouth parts.
- Unlike all other groups of arthropods, no antennae.
- The body is divided into an anterior prosoma and a posterior opisthosoma.
- The prosoma usually consists of eight segments. The first segment never bears appendages, the second bears paired chelicerae (feeding and grasping structures) and the third bears paired pedipalpi (sensory, prehensile or reproductive appendages). The fourth to seventh segments bear walking legs (i.e. four pairs) which have small pincers (chelae) at their ends.

Class: Tardigrada

1- Known as water bears or mening slow stepper .

2-are minute organisms usually less than a millimeter in length.

3- They have barrel – shaped bodies with four pairs of stubby legs .

4-Each legs with four to eight claws .

5- The body is covered by a non chitinous cuticle .

6-Cilia are absent.

7-They are the most resilient animal know , they can live in (-272 C°) , pressures about six times greater than found in deepest ocean trenches , ionizing radiation at doses hundreds of times higher than the lethal dose for human , the vacuum of outer space they can go without food or water for more than 30 years and drying out to the point where they are 3%or less water .

Milnesium

1-Cosmopolitan species that can be find in a diverse range of environment , These species occupies mostly a quatic environments such as marine , coastal and terrestrial areas .

2-Has a symmetrical body with 8 legs .

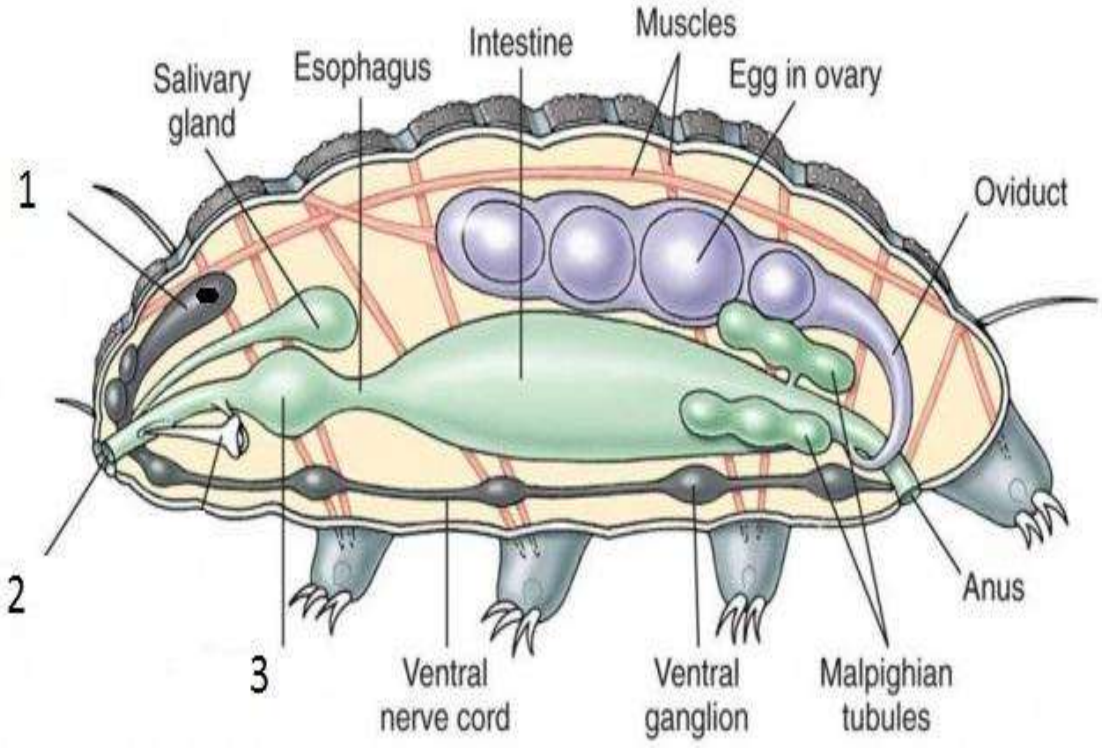
3-Utilize claws , total length of the body varies with some measuring up to 0.7 mm in length .

4-Has been found to have a high level of radio resistance and live in space and in absolate zero conditions .

5-Is an omnivorous predator , feed on other small organism such as algae , rotifers and nematodes and can feeding on other smaller tardigrades .

6-Reproduction both sexually and parthenogenesis , female lay -up to 12 eggs which hatch several days (5-16) days .

7-Larvae development from shape to another by molting and that molting depended on the nutrition of species .



LAB. 8 Phylum *Mollusca* (Mollusks)

Characteristics of Phylum Mollusca :

1. Body bilaterally symmetrical (bilateral asymmetry in some); unsegmented; often with definite head.

2. Ventral body wall specialized as a muscular foot, variously modified but used chiefly for locomotion.

3. The body consist of head , foot , mantle and visceral mass .

4. Dorsal body wall forms pair of folds called the mantle, which encloses the mantle cavity, is modified into gills or lungs, and secretes the shell (shell absent in some) its an exoskeleton calcareous consisting of one or more piece and used to protect the body .

5. Surface epithelium usually ciliated and bearing mucous glands and sensory nerve endings.

6 . Coelom limited mainly to area around heart, and perhaps lumen of gonads and part of kidneys.

7. Complex digestive system; rasping organ *(radula) usually present; anus usually emptying into mantle cavity.

8. Open circulatory system consists of heart (one or two auricles and one ventricle) , aorta and sinsus .

9. Gaseous exchange by gills called ctenidia , lungs, mantle, or body surface.

10. One or two kidneys (metanephridia) opening into the pericardial cavity and usually emptying into the mantle cavity.

11. Nervous system of paired cerebral, pleural, pedal, and visceral ganglia, with nerve cords and subepidermal plexus.

12. Sensory organs of touch, smell, taste, statocysts , and eyes (in some) , eyes highly developed in cephalopods.

13. Both monoecious and dioecious forms; spiral cleaveage; larva primitively a trochophore, many with a veliger larva, some with direct development.

14. Fertilization is internal or external .

- **Phylum Mollusca Classification**

Class :1. Monoplacophora (Gr., monos, one+ plax, plate+ pherein, bearing)

- Body is bilaterally symmetrical and segmented.
- Mantle dome-shaped.
- The shell comprises a **single piece** or valve.
- Head without eyes and tentacles.

Examples: *Neopilina*

Class 2. : Polyplacophora

- Body elliptical and flattened.
- Shell of mid dorsal row of 8 broad plates.
- Foot ventral , large , broad muscular.
- Mantle surrounds the shell as fleshy girdle with scale and spines.
- Sexes separated.
- Ex: *Chiton*

Class 3. Aplacophora

- Body elongated with reduced head.
- Radula present.
- Shell as 8 dorsal plates or as spicules.
- Examples: *Neomenia*.

Class 4. Scaphopoda (Gr., **Scapha**, boat + **podos**, foot)

- Burrowing and marine molluscs known as tooth shell.
- Body, bilaterally symmetrical, elongated with no distinct head, and without eyes and gills.
- Shell and mantle univalve, cylinder or tubular and open at both ends.
- Foot small , conical .
- Sexes separated. Ex: *Dentalium*

Class 5. Gastropoda (Gr., **gaster**, belly + **podos**, foot)

- Head distinct with one or two pairs of tentacles and eyes and containing a scraping radula.
- Shell univalved , often spiral or conical or absent.
- A large ventral foot in the form of a creeping sole.
- Gills 1 or 2 or replaced by secondary gills or lung.
- Nepheridia 1 or 2.
- These animals are basically bilaterally symmetrical, but because of torsion, a twisting process that occurs in the veliger stage, their visceral mass has become asymmetrical.
- Sexes separated or united.
- Marine, fresh water or terrestrial and few parasitic on Echinoderms .
- **Ex. *Helix***

Class 6. Pelecypoda (Gr., **pelekus**, batchet+ **podoa**, foot)= Bivalve (Bi mean possess two shells) = Lamellibranchiata .

- Aquatic, mostly marine, some freshwater forms.
- The body is bilaterally symmetrical and laterally compressed.
- Bivalve shells hinged together and mid-dorsally.
- Head is not distinct; pharynx, jaws, radula, and tentacles
- ***EX. Anodonta.***

Class 7. Cephalopoda (=Siphonopoda) (Gr., kephale, head+ podos, foot)

- Marine and free-swimming.
- The body is bilaterally symmetrical with head and trunk.
- Body elongated dorso-ventrally.
- Shell external, internal or absent.
- Head distinct and large with well-developed eyes and mouth.
  - **Ex. *Octopus***

Helix

1 -It is called (garden snail) Is common terrestrial , air breathing gastropod . it is nocturnal and feeds on leafy vegetation.

2-Mantle: The thin mantle covers the visceral hump and forms the roof of the mantle cavity. It is thickening anteriorly to form collar that secret the shell.

3- Shell: the shell is thin, with low conical spire, measuring 4 cm in length ,the shell has a smooth aperture and prominent lines of growth.

4- Foot is undivided longitudinally and Head comprise of two pairs of tentacles and mouth . the posterior pair of tentacles bears eye and it is longer than the anterior tentacles.

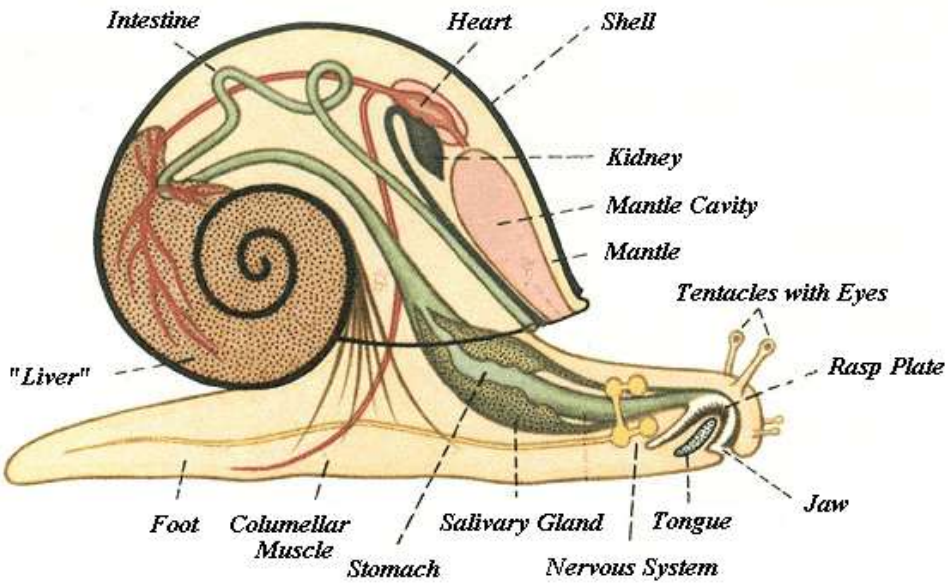
5- Digestive system: contain from mouth is opened into buccal cavity with buccal mass (radula , cartilages and muscles) , the buccal cavity connected with esophagus and crop which surrounded with salivary gland. Then Stomach , Intestine and rectum which lead to anus.

6- Respiratory system: Gills are absent in Helix There is a small opening called pneumostome diffusion of gases occurs between the air and the blood.

7- Blood vascular system: Heart is located in the pericardium , It is divided into two chambers, an atrium and a ventricle, both connected by a narrow duct, a valve avoiding blood fluid flowing back.

8- Excretory system: only one kidney leads to ureter which open near the anus.

9- Reproductive system: It is a hermaphrodite animal cross fertilization occure between two animals , direct development no larval stages.



Helix anatomy

Dentalium

1- Shape and size: the body is headless , bilaterally symmetrical , slender.

2- *Dentalium* is 13-25 cm long an 2.5 cm diameter.

3- Mantle: the body is completely enveloped in a tubular mantle derived from two larval mantle folds which become united ventrally to form a cylinder open at both ends.

4- The mantle secretes an external, cylindrically tubular , slightly curved and tapering shell open at both ends . it is shaped like trumpet or elephant's tusk.

5- Foot which protrudes from the larger anterior end of the shell, is long , pointed , spade like and highly extensible, the free end of the foot is conical and trilobed , carrying wing like ridge on either side. The conical foot is well adapted for burrowing.

6- Respiratory system: gills are absent , the respiratory exchange of gases taking place through the mantle surface.

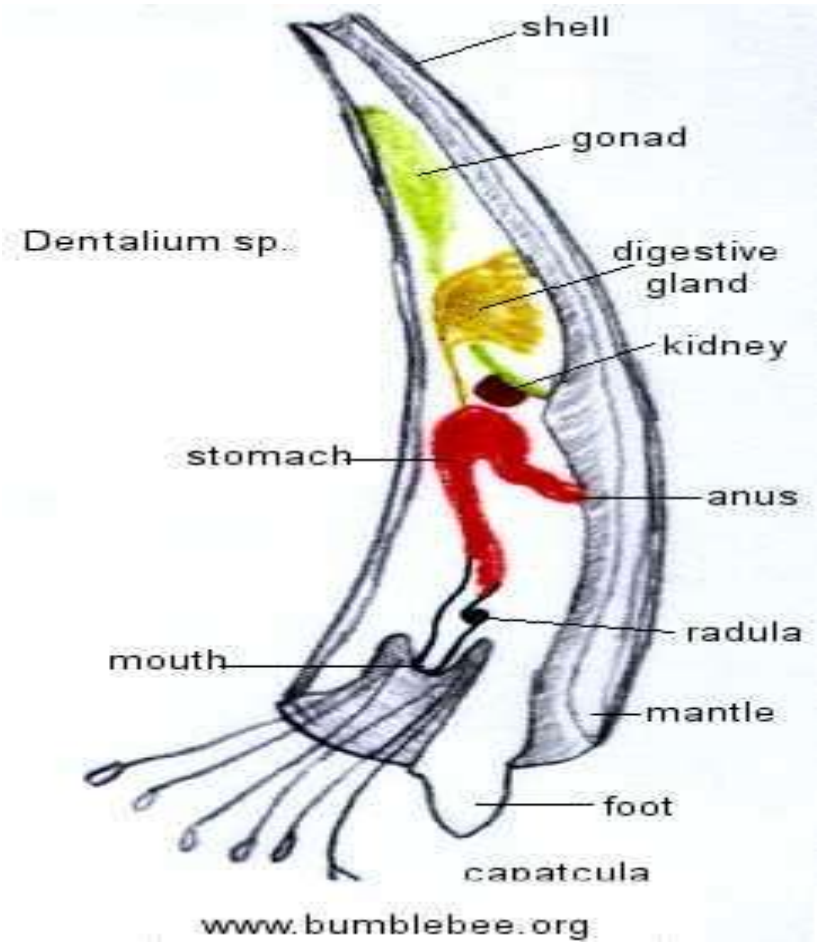
7- Digestive system is contain from mouth , The short esophagus lead into a simple stomach with a caecum and gastric shield. It receives the ducts of a large bilobed digestive gland. The much coiled intestine end into short caeca which open by anus. Anus lying mid-ventrally behind the base of foot in mantle cavity.

8- The circulatory system is extremely simple and colourless .

9- Excretory system: A pair of symmetrical , sac –like (kidney) nephredia is situated in front of the gonad , one on each side of rectum. They open into mantle cavity by a nephridiopore on either side of anus.

10- Reproductive system: the sexes are separated.

11- Nervous system: composed of 4 pairs of ganglia: - - - - Pairs of cerebral gangelia Pairs of plural ganglia Pairs of pedal ganglia Pairs of visceral ganglia.



Dentalium

Octopus

1- *Octopus* is a marine , bottom dwelling nocturnal cephalopod spending daylight hours in rocky crevice. •

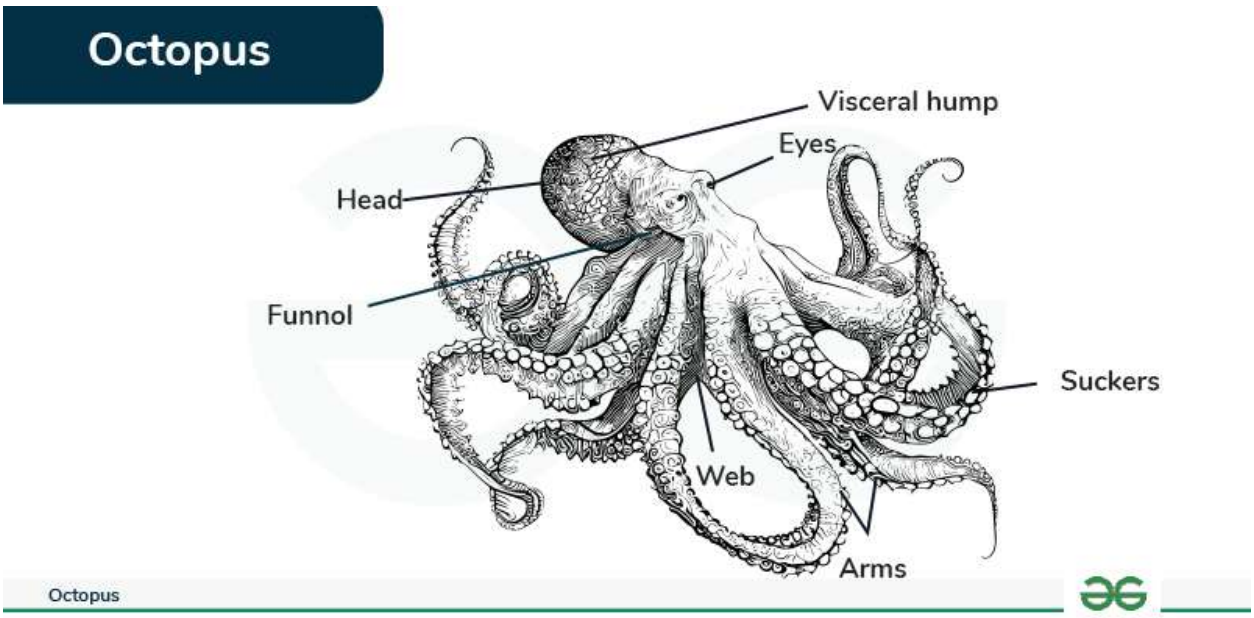
2- *Octopus* is popularly known as a devil-fish.

3- Body is globes and bag-like with large head and trunk.

4- Head bears a pair of eyes and eight elongated equal arms which surrounded the mouth , Each arm bears suckers arranged in two rows. suckers are sessile and large.

5- Third right arm in male is modified into spoon – shaped structure which serves for transferring spermatophore into the mantle cavity of the female for fertilizing ova.

6- Nidamental glands absent. Nidamental glands secrete a capsule or covering material for an egg or egg masses • Shell is absent.



LAB. 9 Phylum : Echinodermata

General characteristics:

1- These are exclusively marine animals.

2- The larval forms show bilateral symmetry and adult forms show radial symmetry and they are triploblastic .

3- **Body Form:** It varies considerably. The body is star-shaped, spherical or cylindrical. It is un-segmented. The body lacks head.

4- The body is unsegmented without a head.

5- The body surface is covered with calcareous spicules.

6- Body cavity has the distinguishing water vascular system.

7- Tube feet help in locomotion and Respiration occurs through tube feet and gills.

8- The brain is absent, but a nervous system is present with a nerve ring and radial nerve cords.

9- Sense organs are poorly developed and include **tactile organs**, **chemoreceptors, terminal tentacles** etc.

10- Sexes are separate and fertilization is external finally Lost parts can be regenerated.

11- body wall consists of an

a-outer epidermis (single layered and ciliated **),**

b-a middle In many Echinoderms there is endoskeleton of calcareous plates in the dermis which are mesodermal in origin.

C-Inner lining of peritoneum.

12- Respiration occurs through a variety of structures, i.e., **papulae, peristomial gills**, **genital bursae** in brittle stars and **cloacal respiratory trees.**

Classification of Phylum Echinodermata:

Phylum Echinodermata is divided into five classes.

Class 1. Asteroidea (Gk. aster- star, eidos- form):

1- Body is star-like.

2- Five arms are usually present which are not sharply marked off from the central disc.

3- Examples: Asterias (Star fish).

Class 2. Ophiuroidea (Gk. Ophis- snake, Oura- tail, eidos- form):

1- Body is star-like.

2- Arms are sharply marked off from the central disc. Ambulacral grooves"Sre absent.

3- Pedicellariae are absent.

4-Examples: *Ophiura* (brittle star).

Class 3. Echinoidea (Gk. echinos- hedgehog, eidos- form):

1- Body is globular or dislike.

2- Ambulacral grooves are absent.

.3-Examples: ***Echinus*** **(sea-urchin).**

Class 4. Holothuroidea (Gk. Holothurion- sea cucumber, eidos- form):

1- Body is elongated and cylindrical.

2- Oral end has mouth surrounded by tentacles.

3- Ambulacral grooves are absent.

4- Spines and pedicellaria are absent.

5- **Examples: *Holothuria* (sea cucumber), *Cucumaria* (sea cucumber).**

Class 5. Crinoidea (Gk. Crinon- lily, eidos- form):

1- Body has a central disc which is attached to the substratum.

2- Arms are branched.

3- Spines and pedicellariae and madreporite are absent.

5-They are commonly called feather stars or sea lilies.

6-Example: *Antedon* (feather star). Sea lilies.

Ophiura (brittle star)

1- Their long, thin arms—usually five and often forked and spiny—are distinctly set off from the small disk-shaped body. The arms readily break off but soon regrow—*i.e.,* are regenerated.

2- The mouth, on the underside of the body, has five teeth; an anus is lacking .

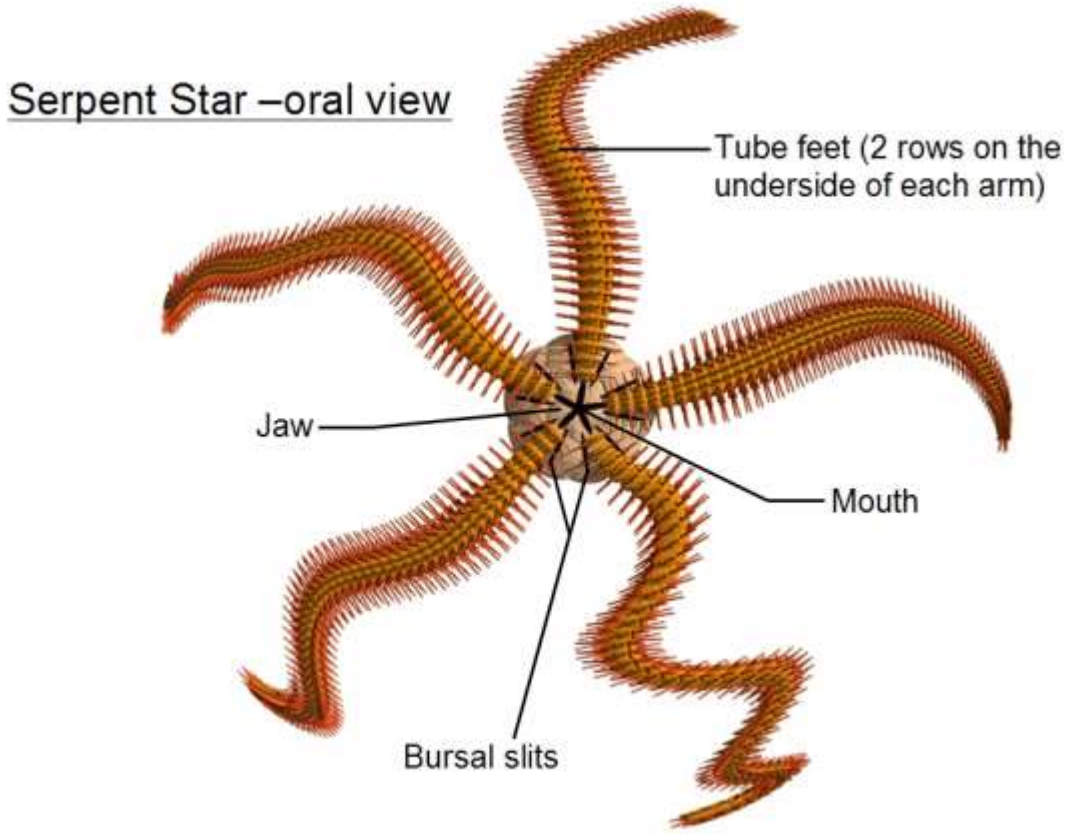
3- the tube feet serve mainly as sense organs for detecting light and odour.

4- The animal feeds by extending one or more arms into the water or over the mud, the other arms serving as anchors.

5- Brittle stars are mainly deposit feeders, scavengers, and plankton feeders.

6- They are capable of moving jerkily but usually cling to the seafloor or to sponges or cnidarians (*e.g.,* coral).

7- Brittle stars occupy many marine habitats, often at great depths.



Echinus (sea-urchin)

1- *Echinus* is a globular sea urchin between 10 and 17 cm in diameter.

2- Spines are short, around 1,5 cm long, thick and regular.

3- Their colour is variable: greenish or pale purple.

4- The thick test (shell) is purple and red with five clearer bands on the ambulacral plate .

5- The mouth is at the base of the animal and the anus at the top; the lower surface is described as "oral" and the upper surface as "aboral".

6- Sea urchins move by walking, using their many flexible tube feet .

7- Digestive system contain from mouth , pharynx , esophagus , small intestine and a single caecum. Digestion occurs in the intestine, with the caecum producing further digestive enzymes.

8- The water vascular system leads downwards from the madreporite through the slender stone canal to the ring canal, which encircles the oesophagus. Radial canals lead from here through each ambulacral area to terminate in a small tentacle that passes through the ambulacral plate near the aboral pole. Lateral canals lead from these radial canals, ending in ampullae.

9- he main circulatory fluid fills the general body cavity, or coelom. This coelomic fluid contains phagocytic coelomocytes, which move through the vascular and hemal systems and are involved in internal transport and gas exchange.

10- Nervous system is simple and there are numerous sensitive cells in the epithelium , sensitive to touch, light, and chemicals.

11- They are dioecious, having separate male and female sexes

LAB. 10 Phylum : Chordata

1- Notochord : the **notochord**, which is a flexible, rod-shaped structure that is found in the embryonic stage of all chordates and in the adult stage of some chordate species. It is located between the digestive tube and the nerve cord, and provides skeletal support through the length of the body. In some chordates, the notochord acts as the primary axial support of the body throughout the animal's lifetime. In vertebrates, the notochord is present during embryonic development, at which time it induces the development of the neural tube and serves as a support for the developing embryonic body. The notochord, however, is not found in the postnatal stage of vertebrates; at this point, it has been replaced by the vertebral column (that is, the spine).

2- Dorsal hollow nerve cord : The **dorsal hollow nerve cord** derives from ectoderm that rolls into a hollow tube during development. In chordates, it is located dorsal to the notochord. In contrast, other animal phyla are characterized by solid nerve cords that are located either ventrally or laterally. The nerve cord found in most chordate embryos develops into the brain and spinal cord, which compose the central nervous system.

3- Pharyngeal slits : Pharyngeal slits are openings in the pharynx (the region just posterior to the mouth) that extend to the outside environment. In organisms that live in aquatic environments, pharyngeal slits allow for the exit of water that enters the mouth during feeding. Some invertebrate chordates use the pharyngeal slits to filter food out of the water that enters the mouth.

4- Post-anal tail: The post-anal tail is a posterior elongation of the body, extending beyond the anus. The tail contains skeletal elements and muscles, which provide a source of locomotion in aquatic species, such as fishes.

5- Coelom : AII chordates have a true body cavity (between the body wall and the gut wall) lined entirely with mesoderm.

Classifications of Phylum Chordata:

Sub-Phylum 1. Urochordata---------- *Ciona .*

1- Adults are generally sedentary (fixed to substratum),

2- This sub-phylum is also called Tunicata because the adult body is enclosed within a leathery test or tunic formed of a cellulose-like organic substance termed tunicin.

3- The notochord is only present in the tail of the larva and disappears in the adult,

4- The dorsal tubular nerve cord is found in the larva. It is replaced by a dorsal ganglion in the adult,

5- The larva (tadpole) is motile and undergoes retrogressive metamorphosis, i.e., change from better developed larva to less developed adult.

Sub-Phylum 2. Cephalochordata (Gr. cephalos- head + chordata = notochord):

1- Both the adult and larva are motile,

2- The notochord extends up to anterior end of the body hence this subphylum is named,

3- The notochord persists throughout life,

4- Pharyngeal gill slits are more numerous and are better developed.

5- The tail is present throughout life,

6- It shows progressive metamorphosis (change from less developed larva to better developed adult).

7-Example: *Amphioxus*

Sub-Phylum 3. Vertebrate or Craniata:

Some of the important characters of vertebrata or Craniata Sub-Phylum are listed below:

(1) These are advanced chordates that have cranium (brain box) around brain.

(2) Notochord is only present in the embryonic stage; it is replaced by a cartilaginous or bony vertebral column in the adult forms.

(3) There is very high degree of cephalization (formation of head).

(4) The epidermis consists of many layers of cells. Epidermis may bear an exoskeleton of scales, feathers or hair.

(5) Three types of muscles, striped, un-striped and cardiac, are present.

(6) Coelom is well developed.

(7) Digestive tract is complete.

(8) The endoskeleton is formed of cartilage or of cartilage and bone.

(9)There is closed circulatory system consisting of blood vascular and lymphatic systems. RBCs are present.

(11) Respiratory organs may be gills, skin, buccopharyngeal cavity and lungs.

(12) A pair of kidneys is present for excretion and osmoregulation.

(13) Nervous system consists of central nervous system (brain and spinal cord), peripheral nervous system (cranial and spinal nerves) and autonomic nervous system (sympathetic and parasympathetic nervous systems).

(14) Sense organs are eyes, ears, tongue, nasal chambers, and skin. In some vertebrates lateral line system is present.

(15) Sexes are separating (unisexual) except hag fish, which is bisexual. There is no asexual reproduction.

(16) Examples : frogs, fish, dogs and human .

Ciona

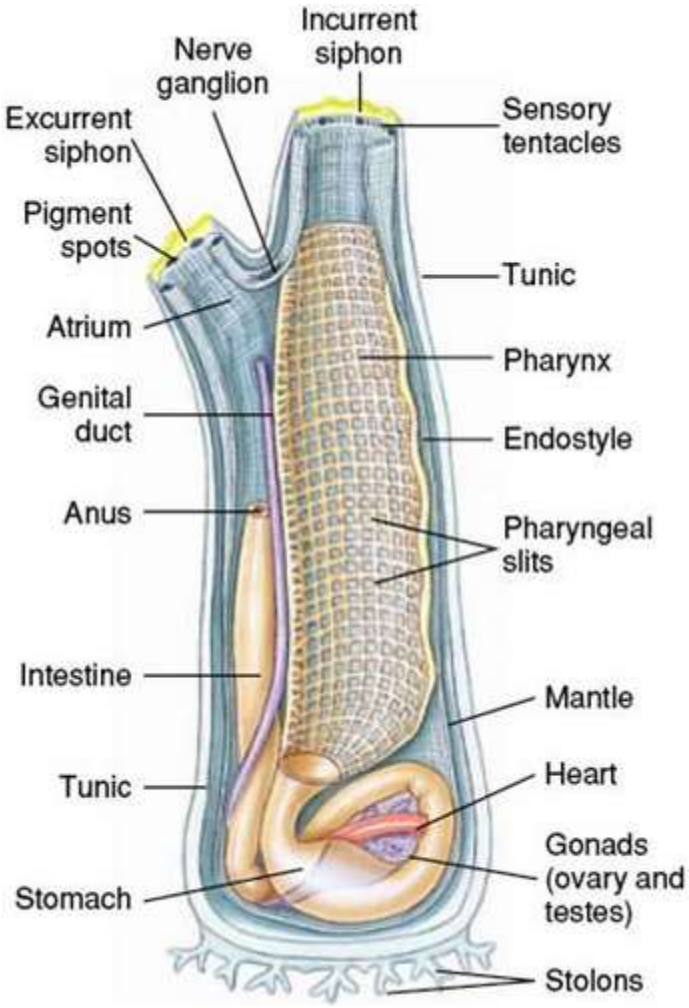
1- are usually found in silty conditions in 0-500 meters (1640 feet) of water. Most are found near rocky shores and estuaries, where the tide of the ocean meets a river current.

2- called tunicates because they have a "tunic" of cellulose-like substance that covers the body , In this tunic are scattered cells, nerves, and blood vessels .

3- They are solitary, and non-colonial organism. It is greenish, translucent, and tubular with terminal inhalent and sub-terminal exhalent siphons (openings) .

4- The larva is dispersive, lasting only 36 hours. It contains a notochord within its muscular tail that is lost at metamorphosis, a dorsal nerve cord, a brain and sense-organs. In its life-history, the tunicate shows retrogressive evolution because the larva contains more features similar to the vertebrates than the adult does .

5- They are hermaphroditic and releases sperm and eggs through the exhalent siphon. Fertilization occurs at sea, and a tadpole-like larva is formed about 25 hours later. The larva lasts about 36 hours, depending on the temperature of the area, after which it settles and metamorphoses into an adult .


Incurrent siphon
Nerve ganglion
Excurrent siphon
Sensory tentacles
Pigment spots
Tunic
Atrium
Pharynx
Genital duct
Endostyle
Anus
Pharyngeal slits
Intestine
Mantle
Tunic
Heart
Gonads (ovary and testes)
Stomach
Stolons

Ciona